

It is claimed:

1 1. A phase detector for generating a phase error signal indicative of a phase
2 difference between a reference signal and an oscillator signal, comprising:
3 an amplifier to convert said reference signal to a substantially square wave signal;
4 and
5 a sampling phase detector to generate said phase error signal from said
6 substantially square-wave signal and said oscillator signal.

1 2. The phase detector of claim 1, wherein said amplifier comprises a
2 saturated amplification stage.

1 3. The phase detector of claim 1, wherein said amplifier comprises a first
2 saturated amplification stage and a second saturated power amplification stage.

1 4. The phase detector of claim 1, further comprising a transformer to convert
2 a single output of said amplifier to a balanced output.

1 5. The phase detector of claim 4, wherein said balanced output have
2 impedances that substantially match the respective input impedances of said sampling
3 phase detector.

1 6. The phase detector of claim 1, wherein said amplifier comprises balanced
2 outputs.

1 7. The phase detector of claim 1, wherein said sampling phase detector
2 includes a balanced output.

1 8. The phase detector of claim 7, wherein said balanced output of said
2 sampling phase detector are respectively coupled to opposite ends of a potentiometer,
3 wherein said phase error signal is generated at a wiper contact of said potentiometer.

1 9. A method of generating a phase error signal indicative of a phase
2 difference between a reference signal and an oscillator signal, comprising:
3 converting said reference signal to a harmonic-rich signal having a rising and/or
4 falling edge; and
5 generating said phase error signal from said harmonic-rich signal and said
6 oscillator signal.

1 10. The method of claim 9, wherein said harmonic-rich signal is a
2 substantially square-wave signal.

1 11. The method of claim 9, wherein converting said reference signal is
2 performed by a saturated amplifier.

1 12. The method of claim 9, wherein converting said reference signal is
2 performed by a first saturated amplification stage and a second saturated power
3 amplification stage.

1 13. The method of claim 9, further comprising converting said harmonic-rich
2 signal to first and second harmonic-rich signals cycling with substantially opposite
3 phases.

1 14. The method of claim 13, wherein said phase error signal is generated from
2 said first and second harmonic-rich signals.

1 15. The method of claim 9, wherein generating said phase error signal
2 comprises:

3 generating first and second phase error signals having substantially opposite
4 phases; and

5 adding respective weighted portions of said first and second phase error signals to
6 generate said phase error signal.

1 16. The method of claim 15, wherein adding respective weighted portions of
2 said first and second phase error signals is performed by a potentiometer.

1 17. A local oscillator, comprising:

2 a reference oscillator for generating a reference signal;

3 an oscillator for generating an oscillator signal; and

4 a phase detector for generating a phase error signal indicative of a phase
5 difference between said reference signal and said oscillator signal, comprising:

6 an amplifier to convert said reference signal to a substantially square wave signal;

7 and

8 a sampling phase detector to generate said phase error signal from said
9 substantially square-wave signal and said oscillator signal.

1 18. The local oscillator of claim 17, wherein said amplifier comprises a
2 saturated amplification stage.

1 19. The local oscillator of claim 17, wherein said amplifier comprises a first
2 saturated amplification stage and a second saturated power amplification stage.

1 20. The local oscillator of claim 17, further comprising a transformer to
2 convert a single output of said amplifier to a balanced output.

1 21. The local oscillator of claim 20, wherein said balanced output have
2 impedances that substantially match the respective input impedances of said sampling
3 phase detector.

1 22. The local oscillator of claim 17, wherein said sampling phase detector
2 includes a balanced output.

1 23. The local oscillator of claim 22, wherein said balanced output of said
2 sampling phase detector are respectively coupled to opposite ends of a potentiometer,
3 wherein said phase error signal is generated at a wiper contact of said potentiometer.

1 24. The local oscillator of claim 17, wherein said oscillator comprises a
2 dielectric resonator oscillator (DRO).

1 25. The local oscillator of claim 17, wherein said reference oscillator
2 comprises a crystal oscillator.

1 26. A receiver or transmitter having at least one frequency conversion stage,
2 wherein said frequency conversion stage comprises:

3 a mixer; and

4 a local oscillator for said mixer, comprising:
5 a reference oscillator for generating a reference signal;
6 an oscillator for generating an oscillator signal; and
7 a phase detector for generating a phase error signal indicative of a phase
8 difference between said reference signal and said oscillator signal, comprising:
9 an amplifier to convert said reference signal to a substantially square wave
10 signal; and
11 a sampling phase detector to generate said phase error signal from said
12 substantially square-wave signal and said oscillator signal.

1 27. The receiver or transmitter of claim 26, wherein said amplifier comprises a
2 saturated amplification stage.

1 28. The receiver or transmitter of claim 26, wherein said amplifier comprises a
2 first saturated amplification stage and a second saturated power amplification stage.

1 29. The receiver or transmitter of claim 26, further comprising a transformer
2 to convert a single output of said amplifier to a balanced output.

1 30. The receiver or transmitter of claim 29, wherein said balanced output have
2 impedances that substantially match the respective input impedances of said sampling
3 phase detector.

1 31. The receiver or transmitter of claim 26, wherein said sampling phase
2 detector includes a balanced output.

1 32. The receiver or transmitter of claim 31, wherein said balanced output of
2 said sampling phase detector are respectively coupled to opposite ends of a
3 potentiometer, wherein said phase error signal is generated at a wiper contact of said
4 potentiometer.

1 33. The receiver or transmitter of claim 26, wherein said oscillator comprises
2 a dielectric resonator oscillator (DRO).

1 34. The receiver or transmitter of claim 26, wherein said reference oscillator
2 comprises a crystal oscillator.